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Does the Tetrahedron Solve The Aerial Problem?

WHAT HAS BEEN ACHIEVED

Distinguished Washington Inventor of the Telephone Devoting His Time and Money Without Stint to Experiments at Baddeck—The “White Flyer” that Can Carry Three or Four Men.

The study of flight in the air has a peculiar charm to one who engages in it. The problem, so simple that the smallest fledgling may in a dozen efforts master it, leads to a dream of the conquest of space and time, perhaps the greatest of which the human mind has ever taken thought. For the past five years Dr. Alexander Graham Bell, the inventor of the telephone, has been experimenting at his summer home near the little village of Baddeck, Nova Scotia, with tetrahedral kites as the means of devising an aerial locomotive.

The region is one most favorable for the study of aerial flight and experiments with different devices to accomplish it. Baddeck, made famous twenty-five years ago in Charles Dudley Warner's quaintly humorous book, “Baddeck and that Sort of Thing,” is a little village of 800 souls, far out of the traveled pathway and pleasure, where the inventor may ply his trials of kites and motors without an ever-present throng of quizzical spectators or incredulous newspaper reporters.

When Dr. Bell first took up the study of kites, he made use of the old-fashioned Hargrave box model. This was invented in 1892, by Laurence Hargrave, of Australia. The box kite

as a unit flies well, but when enlarged is unwieldy, and when multiplied in many units does not go together sufficiently well to encourage the use of it. Triangular kites were next tried, and later those with circular cells and with cells of six, eight, and twelve sides. None of them succeeded. The ratio between the weight of structure and the buoyant surface soon demonstrated that they could not be employed. After many failures and much careful study, Dr. Bell hit upon the tetrahedron as the unit form for his kites.

What the Tetrahedron Is.

The tetrahedron is simply a solid figure, with four faces consisting of equilateral triangles. The easiest way to get an idea of it is to take six sticks of equal size and length, lay three of them so as to form an equilateral triangle, stand the other three sticks at the apex of each angle, and bring the tops together. The word tetrahedron is derived from two Greek words meaning “four” and “base,” as the figure has four equal bases. The result is a construction braced equally in every direction, the strongest that any unit form intended for kite construction can secure. Essentially the Chinese a thousand years ago made tetrahedral kites in form. The combination of the Chinese idea and the Hargrave scheme of multiplying units has brought out the Bell kite plan, which thus far is the most successful known, and seems likely to lead on to ultimate success in aerial navigation.

The tetrahedral cell possesses marvelous lightness and strength. It is braced in every direction, so that it may be constructed of the least weight of material in proportion to sailing surface. A special advantage also appears in the fact that no matter how much the unit force is multiplied, the result maintains the buoyancy of the single cell. Kites of unlimited size can be built, and with adequate means of starting can be managed as successfully as the smallest. This is something which has never proved true with other types of construction. Dr. Bell is now able to combine tetrahedral cells so as to produce a kite forty feet wide and requiring the power of a steam tug to start it on its flight. Many of his kites are so large that he starts them by fastening the guide rope to the collar of a horse, which is whipped to a keen gallop across a long field. In a good wind such a start as

this easily sends the kite soaring upward quite as buoyantly and successfully as would be the case with a small kite.

Using Aluminium Tubing.

At the Baddeck laboratory, which has been fitted up without stint of expense. Dr. Bell employes a number of expert mechanics both in the construction and trial of the kites. The framework usually is made of thoroughly seasoned black spruce. At first the sails placed on two sides of a tetrahedron were made of silk. Now they are made of nainsook, which is found to be lighter and much stronger. There is now being constructed a kite consisting of hundreds of tetrahedral cells, in which the frame is of aluminium tubing. Aluminium weighs little more than the spruce and is several times stronger. The sails are attached only at the points of the triangles. The triangles are hinged together, so that they may be taken down and carried flat under the arm. The stock of single tetrahedral cells once made, the height and breadth of the kite is wholly subject to the wish of the owner. He can make it as large as he chooses.

Dr. Bell has given names to his various large kites, calling them “White Flyer,” “Mabel II.” and “Victor I.” These large kites go aloft even in the lightest breeze, and show remarkable equilibrium and steadiness in spite of squalls. Usually they hold the guide rope at an angle of not less than 80 degrees. Both in the flying and in the pulling in at the close of the experiment the kites sail as steadily as a yacht. As the operator reels in the line, the great mass of little triangles, looking like a flock of birds in perfect alignment, sails slowly down and alights as gently as would a bird.

Power of the White Flyer.

The White Flyer is itself a large, three-sided pyramid made of the small tetrahedral cells. It has lifting power sufficient to sustain three or four men. Mabel II has been arranged with three long boats covered with oil cloth, so that the kite may be started from the surface of a near-by body of water. The boats are connected by strong trusses, and resting on these

are four large kites like the White Flyer, each consisting of sixteen large tetrahedral cells. In all, there are 272 cells in the kite.

The upper tiers of the kite are of red nainsook and the lower of white. When everything is ready this huge kite is towed out into the bay and her flying line made fast on board the tug, which is started ahead at full speed, twelve or thirteen knots an hour. On the first trial of this remarkable kite a heavy downpour of rain set in, and, the line being too short, there was fear that she would not fly. But no mishap occurred, and the great kite, with her three boats heavily loaded with water, rose as gracefully as a bird and made a successful flight.

Dr. Bell's Theory.

It is Dr. Bell's belief that a kite which would successfully bear aloft the weight of three or four men achieves the successful ratio between sailing surface and construction weight, and that with properly made propellers it will fly equally well under motor power as when pulled by a rope, either with a horse or a tug. The large kites have ample space in the interior for the motor and the passenger, and from the experiments already made it seems not unlikely that they possess a steadiness of flight when once started that would make them easily controllable by the operator.

It has been found that the kites, when they reach a height of from 2,000 to 3,000 feet, encounter breezes that are much more uniform and steady in their direction and course than those which may be blowing at the time on the surface of the earth. Not infrequently it happens that when there is entire calm at the surface of the earth, the kites will enter a breeze blowing at the rate of eight or ten miles at a height of 2,000 feet.

Some idea of the buoyancy of the tetrahedral kite may be gained from the statement that, it has twenty-five square feet of supporting surface to each pound of weight in the structure. A wild duck, whose flight is perhaps as rapid as that of any of the bird kind, has only one-half of a square foot of supporting surface in its wings to a pound of weight. Another comparison affords some estimate of the wonderful buoyancy of Dr. Bell's kite. He

has estimated that the mosquito possesses far greater powers of flight than the bird. For instance, a pound of mosquitos has an area of wing surface of forty-nine square feet. The tetrahedral kites attain fully one-half of this ratio.

Motor Problem Unsolved.

Dr. Bell will resume his work on the kites this summer. His workmen have been engaged this year on a new kite modeled on the plan of Victor I, which is expected to be more wonderful than any of its predecessors. Victor I has shown remarkable facility in starting, rising from the hand, without runing, in the lightest breeze. Its model is so strong that a heavy man could stand on the apex. In other words, Dr. Bell has achieved in this new kite a lightness that, as compared to the Eddy or Hargrave kites, is as 100 to 1.

The problem involved in the use of the motor is one which must be approached very slowly. Even the remarkable engine constructed by Mr. Manley for the Langley aeroplane is not regarded as possessing sufficient strength to operate the largest Bell kite. When Dr. Bell finds a motor sufficiently strong and light, he expects to conduct a series of experiments with his windboat, starting from the surface of the bay, and undertaking to ascend by skimming and making short flights at a moderate height of water, without danger to life. He will not undertake a speed greater than ten or fifteen miles an hour. As the operator gains knowledge of the emergencies that beset aerial flight he will turn on the power and increase the altitude and distance.

Dr. Bell is now very confident that he has by slow stages and great care approached very near the t?ne when he can make a successful flying machine. He does not regard the problem as one that cannot be solved. Whether he will succeed or not is a matter of the future, but he is confident that ultimate success has been constributed to very largely by his use of the tetrahedral kite.